Konza Prairie Background Bidirectional Reflectance Characterization

Final Report for Period
April 1, 1987 - June 14, 1994

NASA Grant NAG5-894

by

Elizabeth A. Walter-Shea and Blaine L. Blad

Department of Agricultural Meteorology
Institute of Agriculture and Natural resources
University of Nebraska-Lincoln
Lincoln, Nebraska 68583-0728

November 1994

Brief Summary of Project

NAG 5-894 was originally established to fund the FIFE project "Measuring and Modeling Near-Surface Reflected and Emitted Radiation Fluxes at the FIFE Site" for the period 4/15/87 through 5/31/90 with a no-cost extension through July 31, 1992. The need for further work in the FIFE Follow-On project resulted in the continuation of the grant to fund research for the "Konza Prairie Background Bidirectional Reflectance Characterization". The intent of this Follow-On project was to collect data which would aid in the understanding of the contribution of standing vegetation and underlying thatch to the overall prairie grassland reflectance.

FIFE. The FIFE results are documented in numerous semi-annual reports with final reports submitted in June 1990 and January 1993.

FIFE Follow-On. The aim of the FIFE Follow-On project was to collect a data set which would aid in the characterization of standing dead vegetation and thatch contribution to prairie canopy bidirectional reflectance. Bidirectional reflectance factors in the solar principal plane and supporting ancillary data were collected in June and September 1993 over burned and unburned prairie grassland plots on the Konza Prairie, Kansas. Canopy reflectance was measured using a Spectron Engineering SE-590 Spectroradiometer in the 400-1000 nm spectral range mounted on a hand-held, pointable mast. The mast was directed in seven directions (nadir and ± 50, ± 35 and ± 20 either side of nadir). Three plots at each of four sites (two of each treatment) were selected for measurement. A series of measurements were made at a pair of burned and unburned sites. The measurement series was: 1) measurement of canopy reflectance over each undisturbed site pair within approximately 20 minutes; 2) clearance of two plots from each site of standing green and dead vegetation, a sample of which was collected for dry weight analysis, leaving the thatch layer (or bare soil in the burned sites); and 3) measurement of canopy reflectance over all three plots per site (2 disturbed, 1 undisturbed) immediately after standing vegetation removal. The thatch was removed from all sites upon completion of reflectance measurements.

Ancillary data included leaf area index (before and after standing vegetation removal), green and standing dead vegetation dry weights, thatch dry weight, leaf optical properties, Munsell bare-soil color code, and total and diffuse incoming solar radiation. Samples of vegetation from a $0.10 m^2$ area was removed from each plot and separated into green, dead and thatch components. Samples were dried in drying ovens for approximately 5 days before they were removed and weighed. At least four replications of reflectance and transmittance of adaxial surfaces of dominant species of standing green, standing dead and thatch were measured. An SE590 mounted on a Li-Cor integrating sphere (with external light source) was used to measure near-normal hemispherical reflectances and transmittances. Total and diffuse incoming solar radiation was collected during the time of canopy reflectance measurements using two Li-Cor pyranometers (one with and one without a shadow band) were recorded using an Omnidata Polycorder.

Data collection was successful (results from measurement from each field campaign were sent in graphic form via facsimile transmission to Mr. Fred Huemmrich on June 24 and September 23, 1993). Data and documentation were submitted to Mr. Huemmrich. The data set has been

used in a canopy reflectance simulation study by Mr. Jeff Privette (University of Colorado). Data submission to ORNL DAAC as part of the FIFE Follow-On project is anticipated by the end of the year.